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ABSTRACT

To determine whether the Posner task, which measures the speed at which information is retrieved from the long term memory, improves prediction of reading comprehension, 121 students from reading and study skills and teacher education courses were administered the Posner task and listening comprehension, reading comprehension, and SAT verbal tests. For the Posner task, students were asked to identify pairs of letters as identical, related, or dissimilar. A comparison of test results indicated that findings from the Posner task cannot be generalized to all reading tests. The retrieval speed measure appeared to add to the prediction of reading comprehension only when the reading measure was closely matched to that of listening comprehension. The varying correlations among the reading comprehension measures suggested that different reading tests tapped different verbal and visual processes. While the Posner task was not always useful in improving prediction of reading comprehension, it does contribute to current efforts to design and develop information processing measurements related to reading comprehension. (Tables of correlation results are included.) (MM)

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Retrieval Speed in Reading Comprehension: Failure to Generalize

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In their attempts to explain individual differences in adult reading comprehension, several researchers have demonstrated that a major predictor of reading comprehension is listening comprehension (Kirby & Das, 1977; Smiley, Oakley, Worthen, Campione, & Brown, 1977). This does not seem unusual, in that both are language processing modes and it has been shown that differences in reading ability may be attributed to differences in language comprehension skills. Reading is differentiated from listening by the additional visual and cognitive processes demanded of the reader, who must extract language from print (Margolin, Griebel, & Wolford, 1982;

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Sticht, 1980).

One visual/cognitive process which has accounted for variance in reading ability beyond that accounted for by listening ability is retrieval speed, that is, the speed by which individuals access information from long-term memory. The rapid retrieval of words from long-term memory has been proposed to be one factor that accounts for the poor reading performance of individuals with adequate or even high intelligence (Satz & Morris, 1981; Chall, 1961). Wolf (1982) made a persuasive case that speed of retrieval, as measured by a picture naming task, is an important determinant of the reading level of school-aged children. In addition, the same point was made by Denckla & Rudel (1968) who demonstrated that speed to name a display of common objects separated non-dyslexics from dyslexics. Thus, it is appropriate that we study the speed of accessing memory information in reading. These memory access processes may play roles in different aspects of reading, such as preparing expectations for cognitive analysis of the material to be read and establishing the direction of eye movements.

Other studies have examined the relationship between retrieval and reading comprehension. Retrieval has been measured by picture naming tasks, in which the total number names is the measure, picture naming in which the speed of naming all the elements of a display is the measure, and reaction time to individual letters or digits. This variety of tasks has made it difficult to make strong inferences regarding retrieval speed and reading comprehension. Additionally,

these tests have not been as successful in differentiating between good and poor adult readers as they have been between good and poor younger readers. Thus, an alternate means of testing important aspects of retrieval speed and their influence on adult reading comprehension is needed.

One task which has been shown to account for differences between listening and reading comprehension in adults is a variant of the Posner task (1969) utilized by Jackson (1980). This is a reaction time task which requires subjects to access memory codes from visual input. The task, which uses capital and small letters, seems to be as useful as any of its variants, which use dot patterns, homophones and nonwords, and shape stimuli for predicting the differences between listening and reading comprehension. Posner's task measures reaction time to make a "same" judgment when two Physically Identical (PI) capital letters are presented or when a capital letter and its corresponding miniscule (Name Identical, or NI) form are presented, and a "different" judgement when a capital letter and a different miniscule letter are presented. To the extent that NI Reaction Time is longer than PI Reaction Time, the extra time is presumed to access and/or compare the names of the two forms of letters. The underlying premise of the Posner task is that the visual stimuli are processed in a temporal hierarchy. The first node at which a match can take place is based on the physical characteristics of the letters. If the two letters do not match at this first node, then further processing is necessary and the subject may find something like the (phonetic) name of the letter in order to make the match.

Recently, the Posner task has been used by several researchers to measure retrieval speed in adult learners (Jacobowitz & Haupt, 1983; Jackson, 1980; Hunt, 1978). These researchers have shown that there is a low to moderate relation between the scores achieved on the Posner task and reading comprehension scores and that the Posner task reaction time scores improves prediction of reading comprehension over that accounted for by listening comprehension alone.

The purpose of the present paper was to examine the generalizability of the finding that retrieval speed, as measured by the Posner task, improves prediction of reading comprehension. Given that retrieval speed has been demonstrated to be a cognitive process that underlies reading comprehension, it was hypothesized that it would account for a significant, and approximately similar, amount of variance in reading performance across a variety of reading tasks using the same adult learners as subjects.

Method

Subjects

Data were collected from 121 students from classes in the Montclair State College Reading and Study Skills Improvement courses and Teacher Education courses.

Apparatus

The microcomputer used for the presentation of the Posner task was a TRS-80 Model I with 48K memory, an expansion interface, a single disk drive, that was previously adapted to present upper and lower case letters. A computer program was written in TRS-80 Level II BASIC to produce a version of the Posner task similar to that utilized by Jackson (1980) and Jackson and McClelland (1979).

Procedure

The computer presented either two physically identical capital letters (e.g., AA), a capital letter and the name-identical miniscule letter (e.g., Aa), or a capital letter and a name-different letter (e.g., Ar) from the set of letters, A, B, D, E, and R. If the two letters had the same name, the student was requested to press the "S" key, and for the third condition, the "D" key. The letters A,B,D,E and R were used and the program took 12-20 minutes to complete, including 20 practice trials and 100 actual test trials. (For a more detailed description of the administration of the Posner task see Jacobowitz and Haupt, 1983).

The listening comprehension task consisted of four short passages (McCall & Crabbs, 1979). Each passage was read aloud by the teacher and the students answered eight questions after each passage was read. One of the reading comprehension tasks also consisted of four passages from the same McCall-Crabbs book. Each passage was paired with one of the listening comprehension passages in terms of topic, length, and difficulty. The reading comprehension task

required each student to read a paragraph silently within a time limit determined by the time taken to read the corresponding paragraph aloud. After each paragraph, the students were allowed two minutes to answer eight questions without referring back to the passages. Using the KR-20 formula, the listening comprehension task was determined to have a reliability of .86 and the reading comprehension measure, .87.

In addition to the McCall-Crabbs reading comprehension test, each student was administered the Diagnostic Reading Test (DRT), a widely used standardized measure of reading comprehension (Committee on Diagnostic Reading Tests, 1966) that has generally been found to be appropriate to describe reading levels at Montclair State College by the Reading Center faculty. This test has separate scores for comprehension of narrative material, expository material, and reading vocabulary.

Finally, SAT Verbal scores were obtained when possible, from college files. Thus, reading comprehension was assessed by several measures: four McCall-Crabbs passages, a standardized reading test made up of three components, and the SAT.

Results

The basic question in this study concerns the extent to which reaction time can supplement listening comprehension as a predictor of reading comprehension which has been measured by several different tests. To investigate this question, SAS PROC REG was used.

Listening comprehension was forced to be the first predictor of reading comprenension and a composite of the MI and PI reaction time scores was entered. As can be seen on Table 1, reaction time only improved prediction of reading comprehension in two instances: the McCall-Crabbs passages and the Verbal SAT.

INSERT TABLE 1 ABOUT HERE

Examination of Table 2 shows that there were moderate to high correlations among the measures of reading comprehension. The variability in the correlations suggests that the tests are heterogeneous and may be tapping different verbal and visual processes.

INSERT TABLE 2 ABOUT HERE

Discussion

The findings of this study raise doubts as to the generalizability, to a variety of reading tests, of the Posner task as a predictor of individual differences in adult reading comprenension. The retrieval speed measure may only add to the prediction of reading comprehension when the reading measure is closely matched to that of listening comprehension, since visual

processes specific to reading have been isolated. In Jackson's study (Jackson, 1980), where retrieval speed, as measured by the Posner task, improved prediction of reading comprehension, the listening and reading comprehension tests were taken from similar sets of passages.

The varying correlations among the reading comprehension measures suggest that different reading tests are heterogeneous and tap different verbal, as well as visual processes. Thus, the influence of retrieval rate may not be as evident in some of these reading comprehension tasks. Further investigation is needed, therefore to closely match measures of reading comprehension to measures of listening comprehension.

The Posner task assumes that that letter matching involves both physical and nominal (verbal) processing. That is, when two letters are visually different, but nominally the same, they are matched using a phonetic or name code involving the phonetic representation of the letter names. This assumption is what makes the Posner task appear to be a valid measure of verbal retrieval processes in reading. However the existence of a phonetic code in simultaneous letter matching (Boles & Eveland, 1983) has been questioned. They provided evidence that the demands of the Posner task are primarily visual in nature. I.e., the letter matching does not take place through a name-matching procedure as has been supposed, but through some process that connects upper- and lower-case versions of the same letter. These findings may account for the findings of this study, discussed earlier, which showed that the Posner task improved

prediction of reading comprehension when the listening task and the reading task were highly matched.

The finding that retrieval speed improved prediction of reading comprehension as measured by the SAT replicates Hunt's results (Hunt, 1978), and may be due to the fact that the SAT is not just a measure of reading comprehension, but of verbal aptitude as well, a factor which is closely related to intelligence. Thus, the variance that remained after listening comprehension was partialled out of the SAT scores may be qualitatively different from the remaining variance in the Diagnostic Reading Test. The Posner task has been demonstrated by Hunt to differentiate retardates from non-retardates and children from adults, indicating that the task captures some of the variance among different intelligence levels and age groups. Thus, while this study suggests that the Posner task may not always be a useful device for improving prediction of reading comprehension, other evidence indicates that it represents one contribution to current efforts to design and develop information-processing measurement related to reading comprehension.

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Table 1

Correlations of Retrrieval Speed and Reading Comprehension

Controlling for Listening Comprehension

Reading Comprehension Test	$r_{Test*RT.ListComp}$	p
McCall-Crabbs passage 21	.117	<.40
" 39	.265	<.03
" 49	.177	<.08
" 55	.235	<.10
Multivariate Test (Wilk's lambda)	$F(4,36)=2.68$	<.05
DRT Narrative subtest	.014	<.90
" Expository subtest	.175	<.16
" Vocabulary subtest	.128	<.32
Multivariate Test (Wilk's lambda)	$F(3,43)=1.44$	<.25
SAT Verbal subtest	.325	<.05

Table 2

First Order Correlations of Listening Comprehension and Reading Scores

	SAT	DRT			Reading
	Verbal	Narrative	Expository	Vocabulary	Comprehen
Listening Comp (McCall Crabbs)	.70**	.37*	.58**	.53**	.82**
SAT Verbal	---	.43*	.66**	.47*	.74**
DRT Narrative		---	.68**	.51**	.71**
DRT Vocabulary			---	.64**	.64**
Reading Comprehension (McCall Crabbs)				---	.64**